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VERIFICATION OF TRANSLATION

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Sir:

I, Hiroshi Ikeda, being a member of Ikeda & Associates, of
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JAPAN, hereby declare that I am well conversant in both the English and
Japanese languages, and that the attached document is a true translation of
the above-identified Japanese Patent Application, made by me into the
English language, to the best of my knowledge and belief.

Date: January 16, 2003

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SPECIFICATION

Title of the Invention:

Card Connector Adapter for Connection of Card with Card Connector

[0001]

Background of the Invention:

Field of the Invention:

The present invention relates to a card connector adapter for use in connection of a card such as a memory card with a card connector.

[0002]

Prior Art:

In the past, portable phones, digital still cameras, digital video cameras and other electronic devices are designed to receive certain kinds of cards incorporating ICs or other semiconductor elements, such as SIM (Subscriber Identity Module) cards, SD (Square Digital) cards, MMC (Multi Media Card) cards and the like. Accordingly, it is common that such electronic devices are provided with respective card connectors for connection and disconnection of the cards necessary for operation of the devices.

[0003]

With the progress of miniaturization of those electronic devices miniaturization of the cards has also been realized to produce each type of miniature cards. As the result, the card connectors designed for use with the previous cards that have not been miniaturized can not mount such miniature cards, and therefore, several types of adapters necessary for mounting such miniature cards have been proposed.

Some examples of such adapters can be found in the following references: Japanese Patent Laid-Open No. 5-233887 describing an adapter for a card-like memory board; Japanese Patent Laid-Open No.10-83434 describing a card-like adapter for a miniature thin card; Japanese Patent

Laid-Open No. 2000-3416 describing a contact adapter for a chip card; and Japanese Patent Laid-Open No. 2000-214971 describing an adapter for CF (Compact Flash) card.

[0004]

The adapters for the card connectors that have been proposed are generally designed to have card-like shape for insertion into and removal from a card-receiving cavity of the card connector. Such card-like adapter has one type of terminals provided on one end thereof for connection with contacts of the card connector, and another type of terminals provided inside of the adapter for connection with contacts of the miniature card. Those two types of terminals are electrically connected to each other via a circuit board installed in the adapter.

In Japanese Patent Laid-Open No. 5-233887, as above, a reference numeral 4 in Figs. 1 and 3 represents an electrical connection means corresponding to that circuit board. In Japanese Patent Laid-Open No. 10-88434, as above, a reference numeral 16 in Fig. 1 represents a connection means that corresponds to the circuit board. In Japanese Patent Laid-Open No. 2000-3416, as above, a reference numeral 21 in Fig. 3 represents one that corresponds to the circuit board. Furthermore, in Japanese Patent Laid-Open No. 2000-214971, as above, a reference numeral 8 in Fig. 1 represents one that corresponds to the circuit board.

[0005]

In this manner, the card connector adapters in the prior art includes a built-in circuit board and two types of terminals each for connection with a card connector and with a miniature card, thereby causing a problem in that it has increased number of components, complicated construction and higher manufacturing cost.

[0006]

In view of the above an object of the present invention is to provide a new

and improved card connector adapter that has less number of components and simplified construction.

[0007]

Summary of the Invention:

To attain such object the present invention provides a card connector adapter having a card-like shape for insertion into a card-receiving cavity in a card connector and including an inner cavity for receiving a miniature card, comprising:

a plurality of terminals, each terminal having a contact pad formed on one end thereof for engagement with a contact of each of terminals of the card connector, each terminal further having a cantilevered contact formed on the other end thereof and extending into the miniature card-receiving cavity for engagement with each of contact pads of the miniature card inserted into the cavity.

[0008]

Accordingly, the card connector adapter of the present invention includes only a single type of terminals each having a contact pad formed on one end thereof for engagement with a contact of each of terminals of the card connector and a contact formed on the other end thereof for engagement with each of contact pads of the miniature card, thereby obviating the need for the circuit board for connection between different types of terminals, as in the prior art. Therefore, the adapter having reduced number of components and thus the simplified construction can be realized. Of course, the need of welding the terminals to the circuit board can be obviated.

[0009]

According to one embodiment of the present invention, the adapter may include a dielectric base housing for defining the miniature card-receiving cavity and a dielectric inner housing formed on the base housing, and said terminals may be supported on the inner housing (see claim 2).

[0010]

According to another embodiment of the present invention, each of the terminals may be press-fit to each of terminal-mounting passages in the inner housing, and the length of the contacts of the terminals extending from their press-fit portions may be made substantially equal to each other (see claim 3). As the result, the contact pressure of all the contacts of the terminals can be made substantially equal to each other so that higher reliability in connection with the miniature card can be attained.

[0011]

According to further embodiment of the present invention, the terminals may be displaced in position of their press-fit portions in the inner housing in the direction of insertion and removal of the miniature card so that connections may be made in any sequence between the contacts of the terminals and the contact pads of the miniature card (see claim 4).

[0012]

According to yet further embodiment of the present invention, the inner housing may be disposed on the base housing and fixed thereto by some melting method such as ultrasonic welding (see claim 5). This obviates the need of any adhesive and increases the mass production capability.

[0013]

According to yet further embodiment of the present invention, the base housing may be reinforced with a reinforcement plate extending generally in parallel thereto (see claim 6). The reinforcement plate assists to increase the strength of the base housing. In addition, the reinforcement plate may include a lock member for engagement with the miniature card (see claim 7).

Brief Description of the Drawings:

The present invention will now be described in detail with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a card connector adapter according to the

present invention, illustrating the condition wherein an inner housing is supported on a base housing;

Fig. 2 is a perspective view of the card connector adapter according to the present invention;

Fig. 3 is a perspective view of the card connector adapter according to the present invention, but as viewed from the bottom side;

Fig. 4 is an exploded view of the card connector adapter according to the present invention for explaining its usage;

Fig. 5 is a perspective view of the inner housing;

Fig. 6 is a perspective view of a plurality of terminals that have been stamped and formed;

Fig. 7 is a plan view of the terminals in Fig. 6;

Fig. 8 is a perspective view of an intermediate assembly having a plurality of terminals press-fit to the inner housing;

Fig. 9 is a perspective view illustrating the condition wherein a reinforcement plate is supported on the base housing;

Fig. 10 is a cross section view of the card connector adapter according to the present invention;

Fig. 11 is a perspective view of the reinforcement plate; and

Fig. 12 is an enlarged view illustrating the condition wherein the reinforcement plate is supported on the base housing.

[0014]

Description of the Preferred Embodiment:

Now, the present invention will be described in more detail with reference to an embodiment of a card connector adapter as illustrated in the accompanying drawings wherein the adapter is capable of connecting a miniature card that is smaller than an "SD" card to a card connector that is designed for use with an "SD" card.

[0015]

Fig. 1 is a perspective view illustrating an internal construction of a card connector adapter 1 according to an embodiment of the present invention. An external view of the card connector adapter 1 is illustrated in Figs. 2 and 3. Referring to Fig. 4, the card connector adapter 1 is inserted into a card-receiving cavity 21 of a card connector 2 that is designed for use with an "SD" card. In other words, the card connector adapter 1 has a contour substantially similar to that of the "SD" card. The card connector adapter 1 is provided with a miniature card-receiving cavity 11 into which a miniature card 3 is inserted. When the miniature card 3 is inserted into the card connector adapter 1 which is then inserted into the card connector 2 an electrical connection is made between the miniature card 3 and terminals 22 of the card connector 2.

[0016]

As can be seen in Fig. 1, the card connector adapter 1 includes a base housing 4 and an inner housing 5 both made from dielectric plastic material, as well as a plurality of terminals 6 made from a sheet metal by a stamping and forming process. The base housing 4 includes a bottom wall 41, and sidewalls 42, 43 and a rear wall 44 disposed on the periphery of the bottom wall 41, all the walls defining the miniature card-receiving cavity 11. A plurality of open windows 45 are positioned side by side on the bottom wall 41 adjacent the rear wall 44, as shown in Fig. 3.

[0017]

Referring to Fig. 5, the inner housing 5 is generally in the form of an elongated square rod and is supported on the bottom wall 41 of the base housing 4. The inner housing 5 has a plurality of terminal-mounting passages 51 traversed therethrough. Each of the terminals 6 can be press-fit to each of the passages 51, as described latter. As can be seen in Fig. 5, a portion of the inner housing 5 wherein a second terminal-mounting passage 51 (that is second one from the left-most terminal-mounting passage 51, as

viewed in figure) is formed is forwardly projected, by which a press-fit portion of the terminal 6 within that passage 51 may forwardly be displaced relative to other terminals 6.

[0018]

A plurality of terminals 6 stamped and formed, as shown in Figs. 6 and 7, are press-fit to the terminal-mounting passage 51 of the inner housing 5 at a time to produce an intermediate assembly, as shown in Fig. 8. Then, the intermediate assembly of the inner housing 5 is disposed on the bottom wall 41 of the base housing 4, and thereafter, the inner housing 5 is secured to the base housing 4 with an ultrasonic welding process, for example.

[0019]

A plurality of terminals 6 are stamped and formed from a sheet metal so that they are arranged side by side and coupled to each other via a carrier 61 and coupling parts 62. After press-fitting of the terminals 6 to the terminal-mounting passage 51 of the inner housing 5, the terminals 6 are separated from each other by cutting off the coupling parts 62.

[0020]

Each of the terminals 6 has a mounting section 63 formed at center portion thereof, which is press-fit to the terminal-mounting passage 51 of the inner housing 5. The terminal 6 further has a generally rectangular contact pad 65 coupled to one end of the mounting section 63 via an elongated tie rod 64 and a cantilevered contact 66 formed at the other end of the mounting section 63. That is to say, the terminal 6 is a single type or an integral type of terminal that is one piece from the contact pad 5 to the contact 66. In addition, a barb 67 is formed on each of both sides of the mounting section 63. Accordingly, when the mounting section 63 of the terminal is press-fit to the terminal-mounting passage 51 of the inner housing 5, the barb 67 is bit into and locked to an inner wall of the terminal-mounting passage 51 to form a press-fit portion of the terminal 6, with the result that the terminal 6 is

securely supported on the inner housing 5.

[0021]

As can be seen in Fig. 7, all the terminals 6 have substantially equal length "l" that is measured from the barb 67 on the mounting section 63 to the end of the contact 66 of each terminal 6. In other words, all the terminals 6 have substantially equal effective spring length that is measured from the press-fit portion of the terminal 6 within the terminal-mounting passage 51 of the inner housing 5 to the end of the contact 66 of the terminal 6. Accordingly, all the cantilevered contacts 66 of the terminals 6 are formed to have substantially equal resiliency.

[0022]

Furthermore, the plurality of terminals 6 mounted to the inner housing 5 at a time are displaced in position of the mounting sections 63 forwardly and backwardly in the direction that the contacts 66 extend, as shown in 6 and 7. Accordingly, curved contact portions 68 formed on the ends of the contacts 66 of the terminals are also displaced in their position in the same direction. As the result, when the miniature card 3 is inserted into the adapter toward the contacts 66 of the terminals 6, the contact pads 31 of the miniature card 3 (Fig. 10) are engaged with the contact portions 68 of the terminals 6 in such timing or sequence that the grounding circuit is initially connected and then the signaling circuit is connected.

[0023]

When the intermediate assembly of the inner housing 5 with the plurality of terminals 6 press-fit thereto is disposed on the bottom wall 41 of the base housing 4 then the contact pads 65 of the terminals 6 are aligned with the open windows 45 in the bottom wall 41 so that the contacts pads 65 become exposed outside of the adapter through the open windows 45, as illustrated in Fig. 3. At this time, the contacts 66 of the terminals 6 are directed to the miniature card-receiving cavity 11 of the adapter.

[0024]

Referring to Fig. 9, the base housing 4 with the intermediate assembly of the inner housing 5 disposed thereon is provided with a reinforcement plate 7 spanning over the terminals 6 that are arranged side by side. Furthermore, referring to Figs. 10 and 2, a cover plate 8 formed from dielectric plastic material is mounted over the reinforcement plate 7. In addition, a metal shell 9 is provided adjacent the cover plate 8 to cover the miniature card-receiving cavity 11 on the base housing 4.

[0025]

The reinforcement plate 7 is provided for the purpose of reinforcing the strength of the base housing 4. In this embodiment the reinforcement plate 7 is used that is made from a stainless steel plate by a stamping and forming process to have the shape, as shown in Fig. 11. However, it may be any suitable plastic mold product. As shown in Fig. 9, the reinforcement plate 7 includes a belt-like body portion 71 having such length that it can substantially span the tie rods 64 of the terminals 6, "L" shaped legs 72, 73 formed at both ends of the body portion 71, and an abutting member 74 formed at the center portion of the body portion 71 for abutting against an outer surface of the inner housing 5. One of the legs (73) is provided with an arm-shaped lock member 75 extending substantially perpendicular to the body portion 71.

[0026]

When the reinforcement plate 7 is positioned the legs 72, 73 stand on the bottom wall 41 of the base housing 4, as shown in Fig. 9. Furthermore, the body portion 71 is supported on a support projection 46 provided on the surface of the bottom wall 41 so that some clearance is kept between the body portion 71 and the terminals 6, thereby preventing the terminals 6 from short circuiting to each other and to the reinforcement plate 7, as shown in Fig. 12. The lock member 75 of the reinforcement plate 7 extends toward the

miniature card-receiving cavity 11 along the sidewall 42 to oppose the side edge of the miniature card 3 inserted into the cavity 11.

[0027]

A lock portion 76 is provided on the end portion of the lock member 75 at the inner side thereof to align with a cut-out portion 32 on the side edge of the miniature card 3. Accordingly, as the miniature card 3 is inserted into the miniature card-receiving cavity 11 the side edge of the miniature card 3 acts to bias the lock member 75 outwardly until the cut-out portion 32 on the side edge of the miniature card 3 is aligned with the lock portion 76 of the lock member 75, upon which the lock member 75 restores by resiliency to cause the lock portion 76 to be engaged with the cut-out portion 32. Accordingly, it is possible to keep the miniature card 3 in position within the miniature card-receiving cavity 11.

[0028]

In addition to the lock portion 76 a knob 77 is provided on the end portion of the lock member 75, as shown in Fig. 11. The knob 77 is exposed to the bottom surface of the adapter 1 through a release window 47 in the base housing 4, as shown in Fig. 3. Accordingly, the knob 77 can externally be operated to disengage the lock portion 76 from the cut-out portion 32 of the miniature card 3.

[0029]

When the miniature card 3 is inserted into the cavity 11 in the card connector adapter 1 configured as described above then the contacts 66 of the terminals 6 are faced to and engaged with the contact pads 31 of the miniature card 3 with one-to-one relation to provide respective electrical conduction therebetween. Thereafter, when the card connector adapter 1 with the miniature card 3 inserted thereto is inserted into the card-receiving cavity 21 in the card connector 2 that is designed for receiving the "SD" card then the terminals 22 of the card connector 2 are faced to and engaged with

the contact pads 65 of the terminals 6 of the adapter 1 with one-to-one relation to provide respective electrical conduction therebetween. Accordingly, the contact pads 31 of the miniature card 3 are connected with the terminals 22 of the card connector 2 via the integral type terminals 6 of the adapter 1. Because of all the contacts 66 of the terminals 6 having substantially same effective spring length there is substantially equal contact pressure applied by the contacts 66 to the contact pads 31 of the miniature card 3, thereby providing higher reliability in connection therebetween.

[0030]

Due to the configuration wherein the contact pads 31 of the miniature card 3 are connected with the terminals 22 of the card connector 2 only through the integral type terminals 6 without using any circuit board and the like for relay or connection then the card connector adapter 1 can be produced with reduced number of components and thus the simplified construction can be resulted. Furthermore, because of no circuit board used inside, there is no need of soldering the terminals and the like, which allows reduction in number of manufacturing steps.

[0031]

It is apparent from the forgoing that a card connector adapter of the present invention comprises only integral terminals each having a contact pad formed on one end thereof and a contact formed on the other end thereof, thereby realizing the simplified construction of the adapter with reduced number of components.

What is claimed is:

1. A card connector adapter (1) having a card-like shape for insertion into a card-receiving cavity (21) in a card connector (2) and including an inner cavity (11) for receiving a miniature card (3), comprising:

a plurality of terminals (6), each terminal having a contact pad (65) formed on one end thereof for engagement with a contact of each of terminals (22) of the card connector (2), each terminal further having a cantilevered contact (66) formed on the other end thereof and extending into the miniature card-receiving cavity (11) for engagement with each of contact pads (31) of the miniature card (3) inserted into the cavity (11).

2. A card connector adapter according to claim 1 in which the adapter (1) includes a dielectric base housing (4) for defining the miniature card-receiving cavity (11) and a dielectric inner housing (5) formed on the base housing (4), and in which said terminals (6) are supported on the inner housing (5).

3. A card connector adapter according to claim 2 in which each of the terminals (6) is press-fit to each of terminal-mounting passages (51) in the inner housing (5), and the length of the contacts (66) of the terminals (6) extending from their press-fit portions are made substantially equal to each other.

4. A card connector adapter according to claim 3 in which the terminals (6) are displaced in position of their press-fit portions in the inner housing (5) forwardly and backwardly in the direction of insertion and removal of the miniature card (3) so that connections are made in some sequence between the contacts (66) of the terminals (6) and the contact pads (31) of the miniature card (3).

5. A card connector adapter according to any one of claims 2 to 4 in which the inner housing (5) is disposed on the base housing (4) and fixed thereto by any melting process.

6. A card connector adapter according to any one of claims 2 to 5 in which the base housing (4) is reinforced with a reinforcement plate (7) extending generally in parallel thereto.

7. A card connector adapter according to claim 6 in which the reinforcement plate (7) includes a lock member (75) for engagement with the miniature card (3) inserted into the miniature card-receiving cavity (11).

Abstract of the Disclosure:

Disclosed is a card connector adapter (1) having a card-like shape for insertion into a card-receiving cavity (21) in a card connector (2) and including an inner cavity (11) for receiving a miniature card (3). The card connector adapter 1 comprises a plurality of terminals (6). Each terminal has a contact pad (65) formed on one end thereof for engagement with a contact of each of terminals (22) of the card connector (2). Each terminal further has a cantilevered contact (66) formed on the other end thereof and extending into the miniature card-receiving cavity (11) for engagement with each of contact pads (31) of the miniature card (3) inserted into the cavity (11).

List of Reference Numbers:

- 1: card connector adapter
- 11: miniature card-receiving cavity
- 2: card connector
- 21: card-receiving cavity
- 22: terminal
- 3: miniature card
- 31: contact pad
- 32: cut-out
- 4: base housing
- 41: bottom wall
- 42, 43: sidewall
- 44: rear wall
- 45: open window
- 46: support projection
- 47: release window
- 5: inner housing
- 51: terminal-mounting passage
- 6: terminal
- 61: carrier
- 62: coupling part
- 63: mounting section
- 64: tie rod
- 65: contact pad
- 66: contact
- 67: barb
- 68: contact portion
- 7: reinforcement plate
- 71: body portion

72, 73: leg

74: abutting member

75: lock member

76: lock portion

77: knob

8: cover

9: metal shell

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